(1) Remarks

Dear Examiner,

In the Final Office Action dated 09/01/2005, page 5 in remarks regarding our Affidavit of prior invention, an argument was made that there was insufficient evidence supporting diligence in reducing the invention to practice, between our last recorded diligence date of September 5, 2000, and the initial provisional filing date of October 9, 2002. In particular it was stated that further evidence is needed to establish diligence. In this response, we set out a clear recorded timeline of diligence between the dates of September 5, 2000 and October 9, 2002. Between those two dates many variations of the spot size converter were simulated, fabricated, and measured. We provide recorded highlights of those events.

With the evidence provided in the following continuation of the declaration of prior invention, we now maintain that the amended claims in our response to the First Office Action represent patentable novel structure over the cited prior art.

(3) Declaration filed under section 1.131

We request that the examiner take into account the following continuation of our affidavit of prior invention in our response to the First Office Action, pursuant to section 1.131.

Inventor's credentials

Dr. Little obtained a B.A.Sc. in Electrical Engineering in 1984, and a PhD in Electrical Engineering in 1994, both from the University of Waterloo, Canada. He held a Post Doctoral position, and subsequently a Research Associate position, at the Massachusetts Institute of Technology (MIT) for five years. He has held a Research Professor position and the University of Maryland, as well as positions at Nortel Networks and Fujitsu. He has consulted for a number fiber optic companies. In 2000, he founded Little Optics Inc, and served as its President and Chief Technology Officer. The company has since raised $25M in venture capital. Little Optics Inc pioneered high index contrast photonic circuits. Dr. Little has published over 75 articles in peer reviewed journals and holds several patents in the field.

Place of Invention

The work performed in conceiving, analyzing, and reducing to practice of this invention was performed in the USA.

The following pages and Exhibits from my lab notebook and from a commercial photomask order, combined with those set forth in our response to the First Office Action, detail this invention as occurring before the priority dates of the cited prior art references (Appl. No. 10/006,752 to Lam et. al. and Appl. No. 10/083,674 to Zhou et. al.). They also set forth a timeline of diligence between the date of first documentation of invention and first filing of application, in reducing the invention to practice.

I declare that the data, devices and products of this application were conceived by me on the dates listed. 10/19/05 Brent Little

In our Response to First Office Action, we set forth our initial conception date of May 25, 2000. Between the initially recorded conception date of May 25, 2000, and our priority provisional application date of October 9, 2002 for this application, there was a continuity of diligent activity in analyzing and reducing the spot size converter to practice. The following recorded activities took place between those two dates:

(1) Exhibit A is a copy of page 35 of Brent Little's "Little Optics Lab Notebook #3" showing simulations of a spot size transformer for input output (i/o) coupling to fibers incorporating a tapered waveguide imbedded in a larger waveguide. The recording of these simulations is November 12, 2000.

(2) Exhibit B is a copy of page 37 of Brent Little's "Little Optics Lab Notebook #3" showing simulations of a spot size transformer for input output (i/o) coupling to fibers incorporating a tapered waveguide imbedded in a larger waveguide. This mode transformer is similar to the one of this application, but has the smaller high confinement waveguide buried within the larger waveguide, rather than on top of. The recording of these simulations is December 9, 2000.

(3) Exhibit C is a copy of page 62 of Brent Little's "Little Optics Lab Notebook #3" showing more simulations of a spot size mode transformer for input output (i/o) coupling to fibers incorporating a tapered waveguide imbedded in a larger waveguide. This mode transformer is similar to the one of this application, but has the smaller high confinement waveguide buried within the larger waveguide, rather than on top of. The recording of these simulations is August 15, 2001.

(4) Exhibit D is a copy of page 77 of Brent Little's "Little Optics Lab Notebook #3" showing more simulations of a spot size mode transformer for input output (i/o) coupling to fibers incorporating a tapered waveguide imbedded in a larger waveguide. This mode transformer is similar to the one of this application, but has the smaller high confinement waveguide buried within the larger waveguide, rather than on top of. The recording of these simulations is October 6, 2001.

(5) Exhibit E is a copy of page 12 of Brent Little's "Little Optics Lab Notebook #4" showing sketches of photomask layout used to fabricate and quantify mode transformer performance. The recording of these simulations is February 24, 2002.

(6) Exhibit F is a copy of page 110 of Brent Little's "Little Optics Lab Notebook #3" showing simulations of a spot size mode transformer for input output (i/o) coupling to fibers incorporating a tapered waveguide. This mode transformer is similar to the one of this application. The recording of these simulations is March 2, 2002.

(7) Exhibit G is a copy of page 13 of Brent Little's "Little Optics Lab Notebook #4" showing simulations for a variation of the spot size mode transformer. This mode transformer is similar to the one of this application. The recording of these simulations is April 2, 2002.

(8) Exhibit H is a copy of page 14 of Brent Little's "Little Optics Lab Notebook #4" showing measured data of a fabricated device for the coupling efficiency of coupling from a fiber into a fabricated large waveguide portion of the mode transformer. The recording of these measurements is April 11, 2002.

(9) Exhibit I is a copy of page 20 of Brent Little's "Little Optics Lab Notebook #4" showing scanning electron microscope (SEM) images of a cross section of a fabricated variation of the spot size mode transformer having the small waveguide imbedded inside the large waveguide. The observed "seams' in the fabrication indicated that the small waveguide should be put adjacent to (below or on top) of the large waveguide as originally proposed in the lab book notes of May 25, 2000, August 22, 2000, and September 5, 200. The recording of these measurements is April 25, 2002.

(10) Exhibit J is a copy of page 28 of Brent Little's "Little Optics Lab Notebook #4" showing simulations of a variation of the present mode transformer having more than two sections. The recording of these simulations is June 1, 2002.

(11) Exhibit K is a copy of a purchase order sent to DuPont Photomasks for the spot size converter of Exhibit F. The purchase order is for a set of photomask reticles that was subsequently used to fabricate the structure of Exhibit F.

Conditional Request for Constructive Assistance

Applicant has amended the specification and claims of this application so that they are proper, definite and define novel structure which is also unobvious. If, for any reason this application is not believed to be in full condition for allowance, applicant respectfully requests the constructive assistance and suggestions of the Examiner pursuant to M.P.E.P. section 2173.02 and section 707.07(j) in order that the undersigned can place this application in allowable condition as soon as possible and without the need for further proceedings.

Very Respectively,

Brent E. Little
Applicant Pro Se

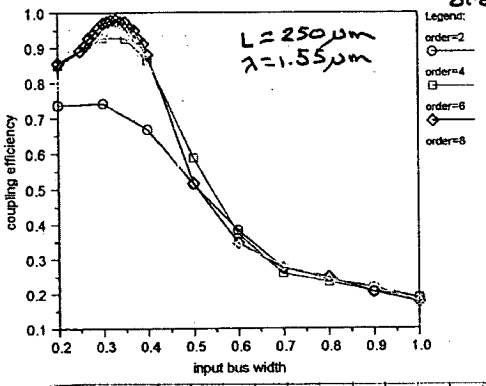
Exhibit A

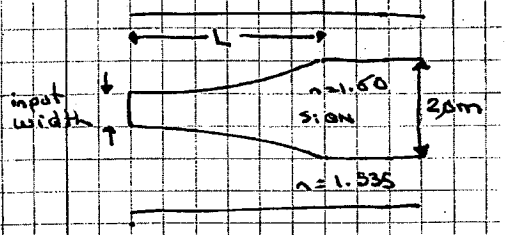
35

SiON tapered s/o waveguides in Cyclotene

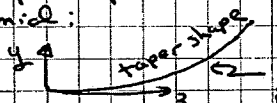
Nov 13, 2003

Taper order





The taper shape follows a polynomial:



$y \propto z^N$ where N = order

Efficiency versus taper length

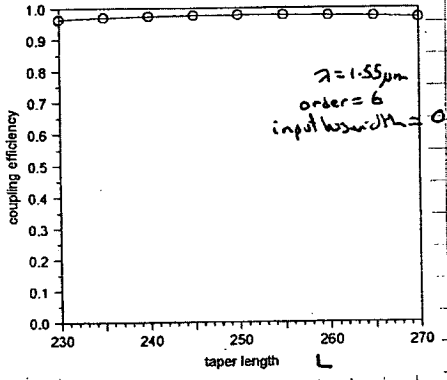
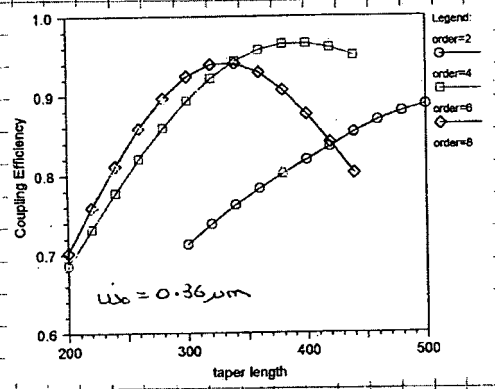
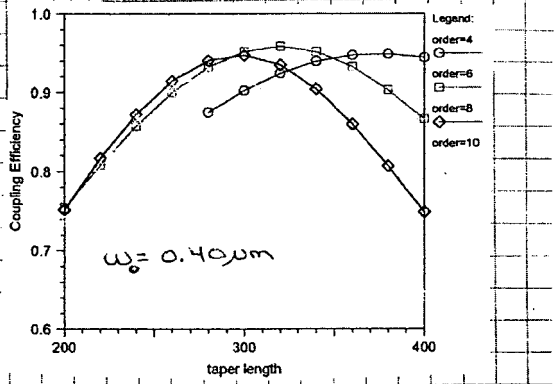


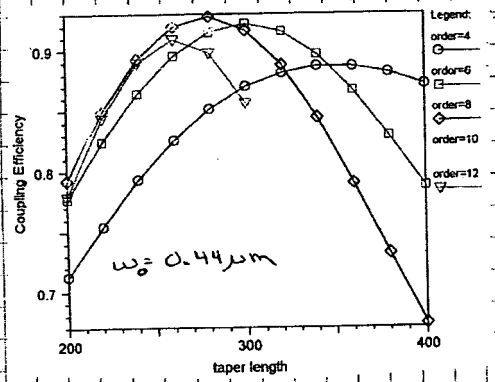
Exhibit B

37

SiON tapered i/o waveguides in BCB – FBCB Dec 9, 2000







Low index contrast waveguide for fiber matching

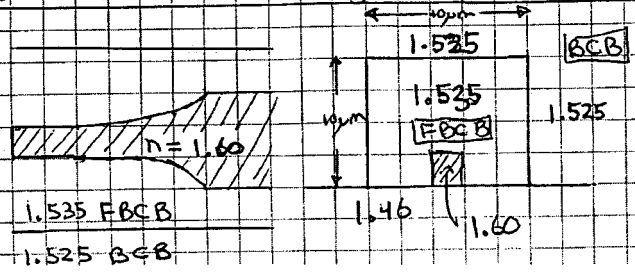


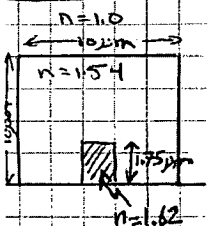
Exhibit C

62

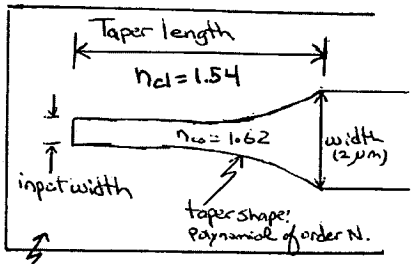
More Mode transformer Simulations

Aug 15, 2001

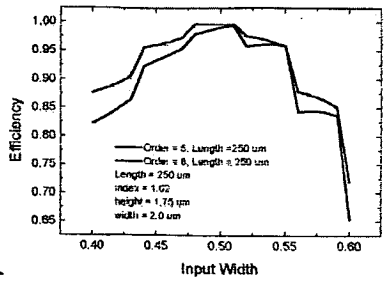
Cross-Section

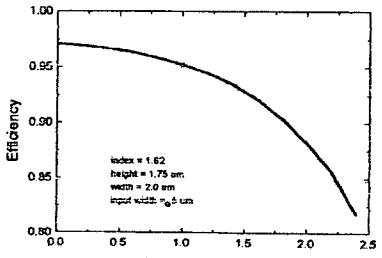


Top-Down $n = 1.0$



fiber mode matched guide 10μm x 10μm





misalignment between SiON and the centre of the BCB guide

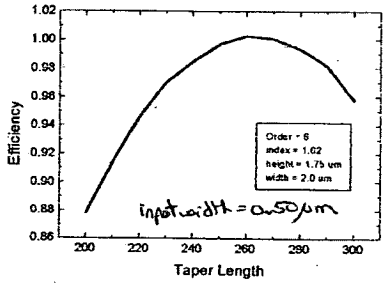


Exhibit D

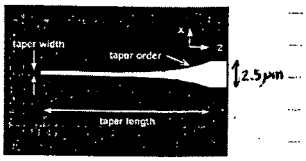
Mode transformer Sensitivity Analysis

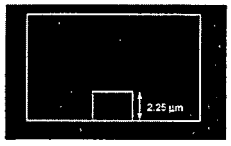
77

Oct 6, 2001

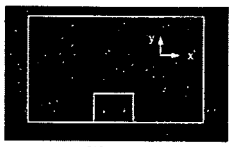
Mode Transformer Analysis

Nominal Values
SiON thickness = 2.25 µm
SiON index = 1.60
maximum width = 2.5 µm
taper length = 275 µm
taper order = 6th
BCB = 10 x 10 um, index = 1.54
taper width = 0.41 µm
wavelength = 1550nm
polarization = TM
Cover index = 1.49

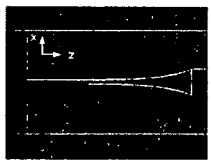




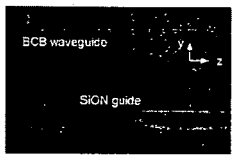
Input BCB Field



SiON Field

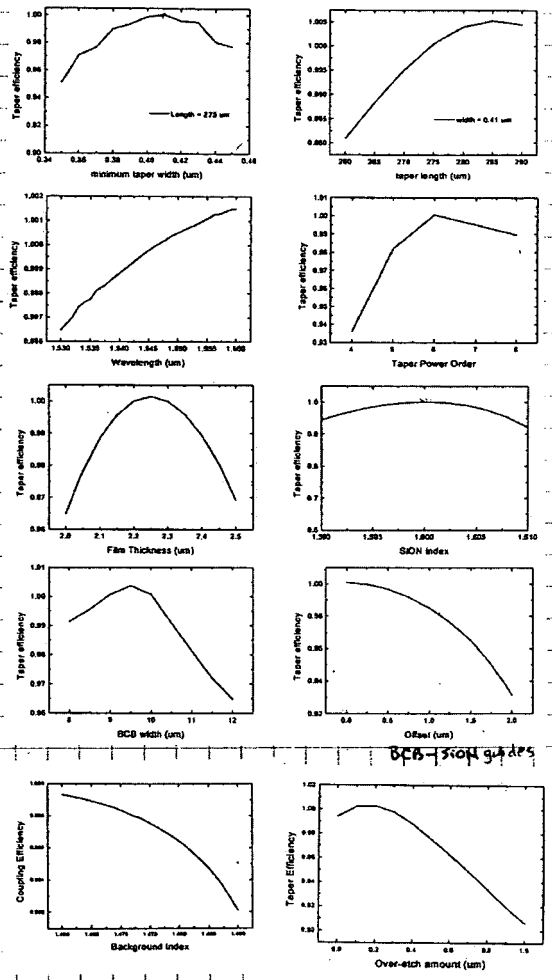


top down view



side view

Sensitivity Analysis



BCB-SiON guides

Exhibit E

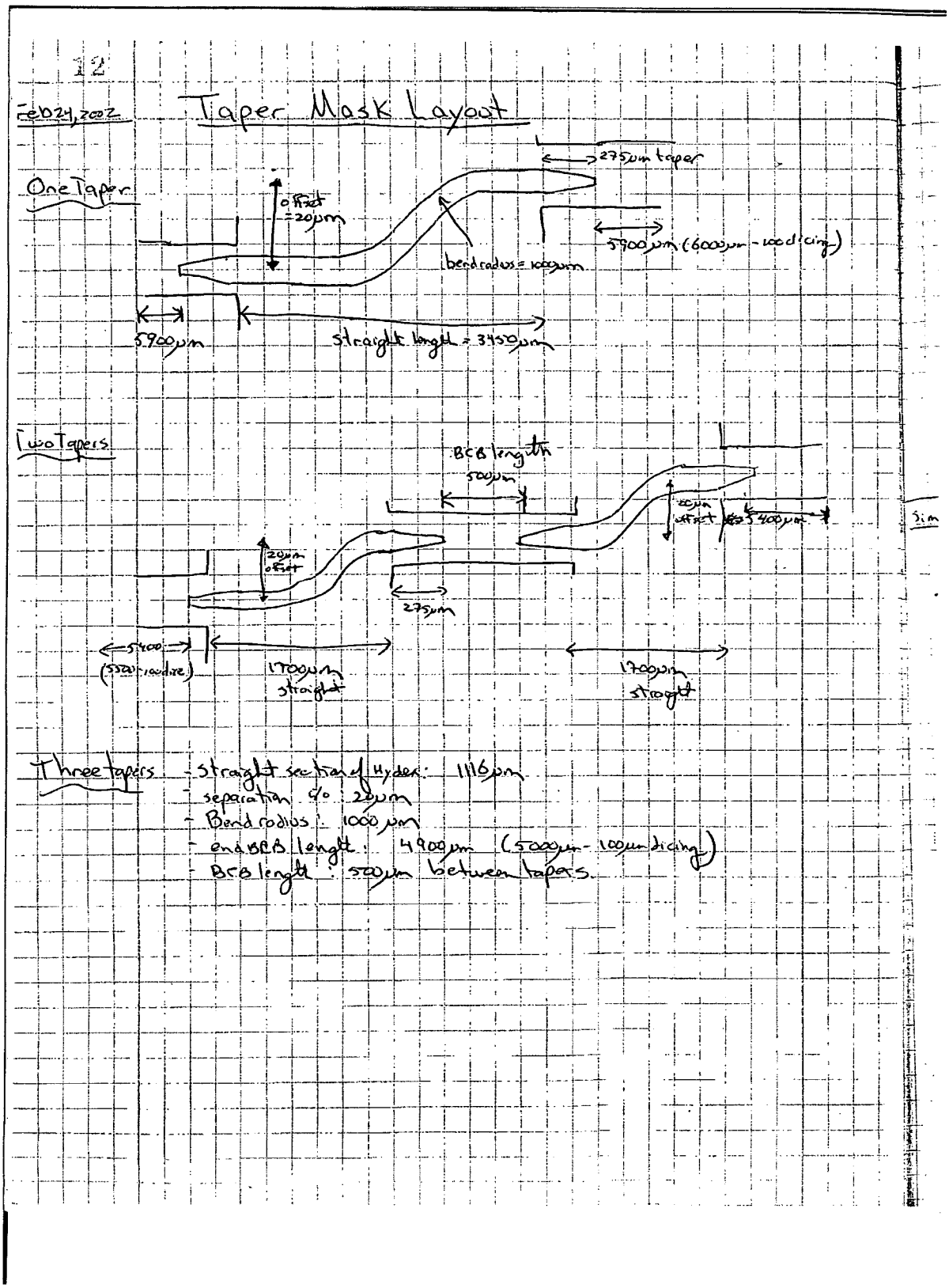
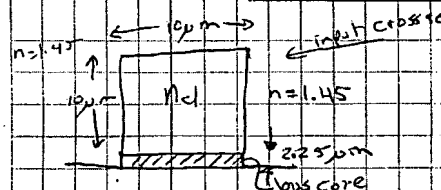
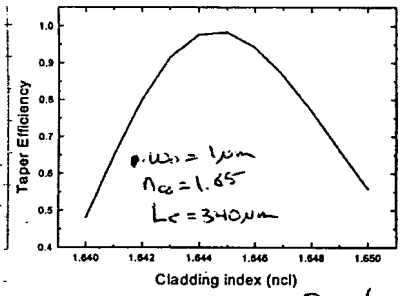

12
Feb 24, 2002
Taper Mask Layout
One Taper
275μm taper
offset = 20μm
5900μm (6000μm - 100d icing)
bend radius = 1000μm
5900μm
straight length = 3450μm
Two Tapers
BCB length 500μm
20μm offset
5400μm
275μm
5400 (5500 - 100d ice)
1700μm straight
1700μm straight
Three tapers
- Straight section between tapers: 1116μm
- separation d: 20μm
- Bend radius: 1000μm
- end BCB length: 4900μm (5000μm - 100μm dicing)
- BCB length: 500μm between tapers

Exhibit F

110

March 2, 2002 Mode Transformer based on Pinched-off waveguide.



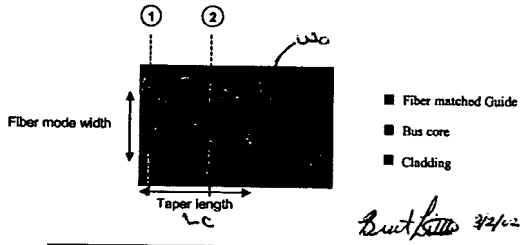


Simulation of Mode Transformer efficiency.

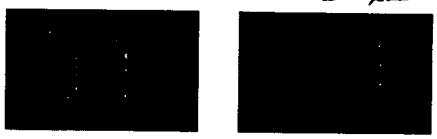
Mode Transformers

Pinched off fiber guide

In this mode transformer, the bus core is situated below the large fiber matched waveguide, rather than imbedded in the larger guide. The width of the bus waveguide is made large, on the order of 10 um, or as large as the fiber matched waveguide. The fiber matched waveguide is then tapered down to a point, typically with a linear taper.



Brent Little 3/2/02



Brent Little 3/2/02

Exhibit G

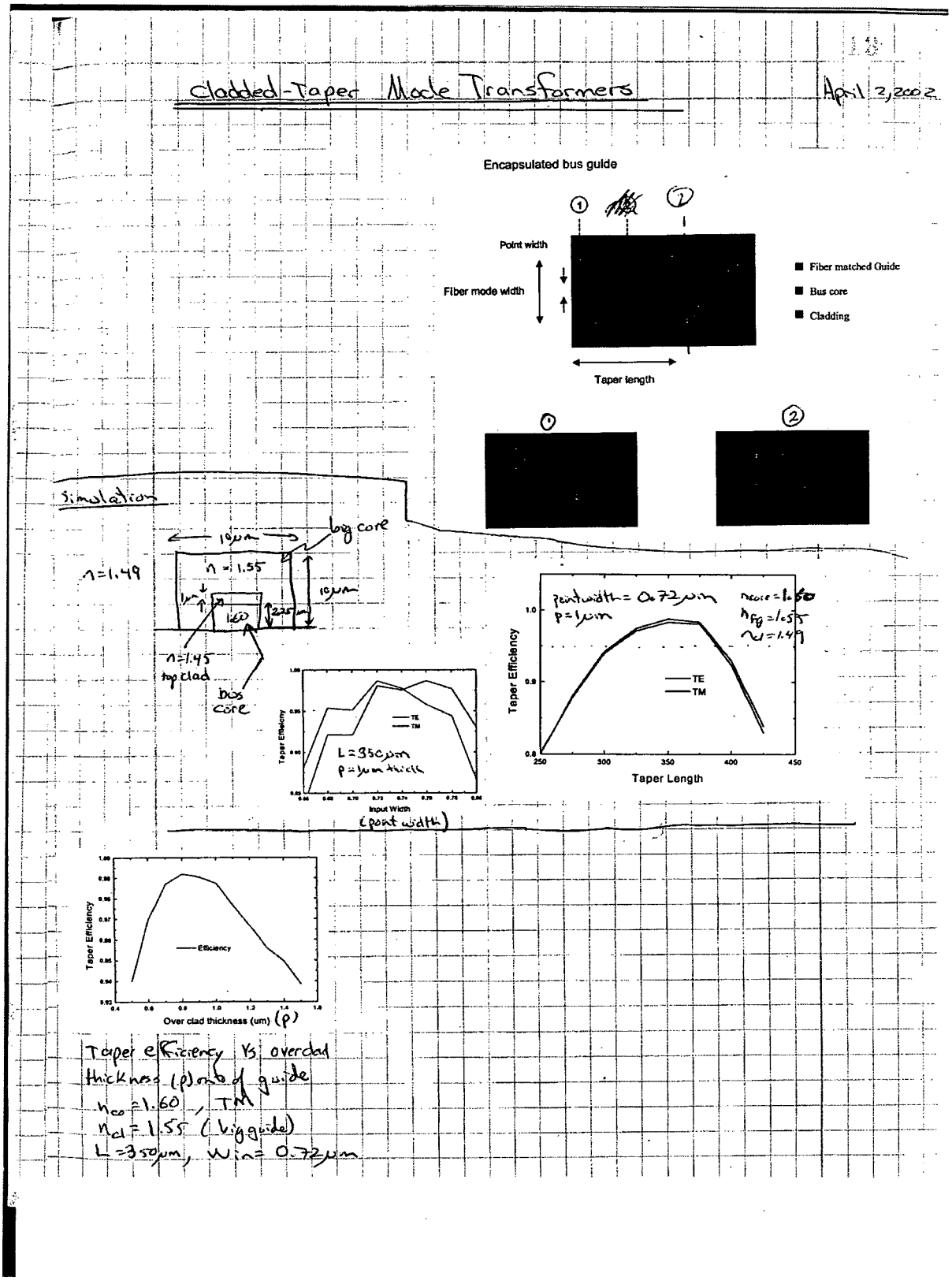


Exhibit H

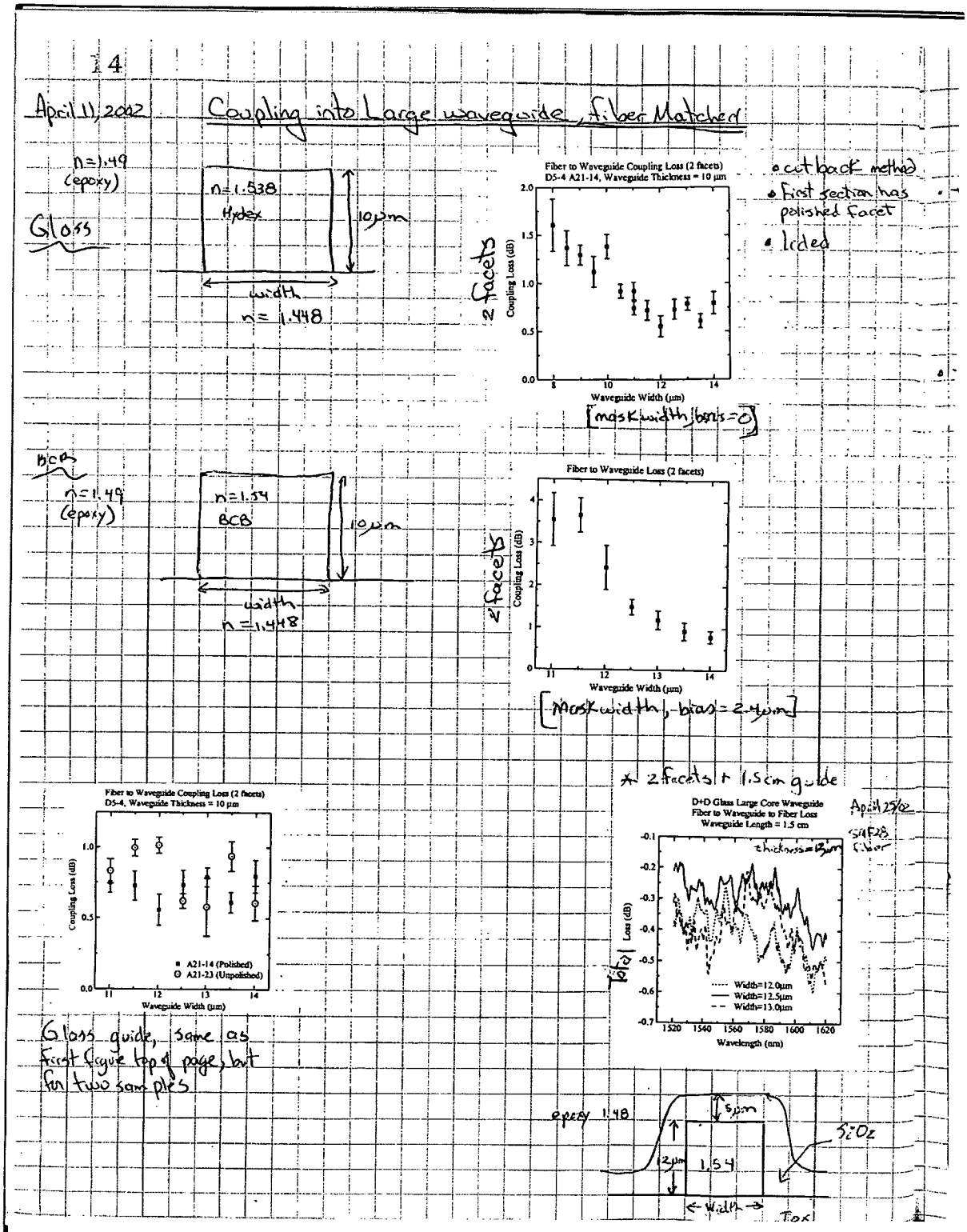


Exhibit I

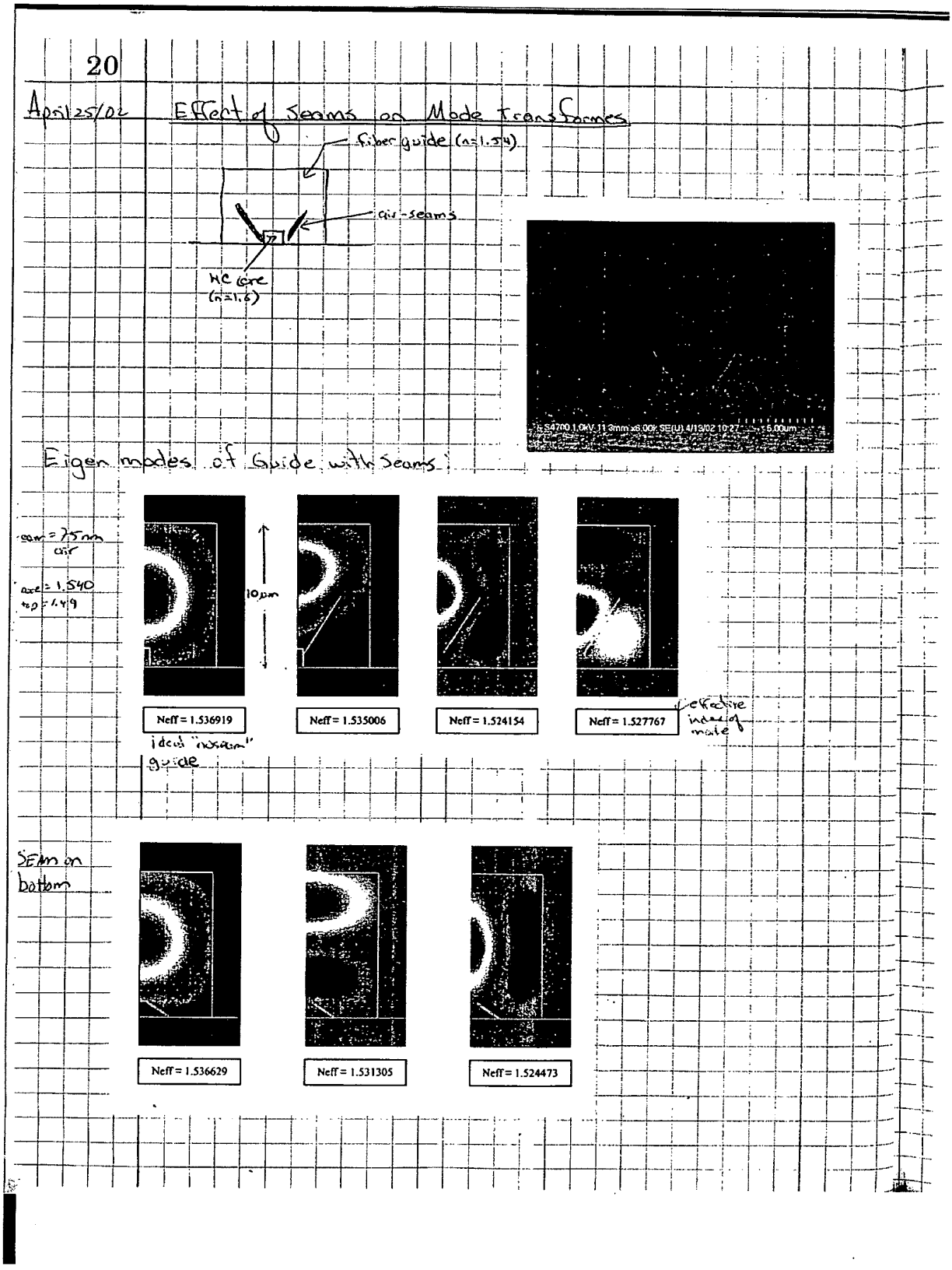


Exhibit J

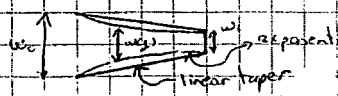
28

lure 1/02

Staircase Taper

This taper approximates a vertical taper by means of descrete vertical steps (etched steps)

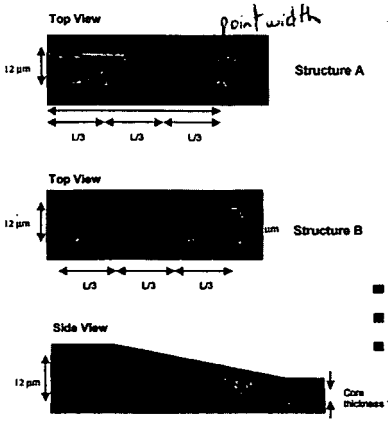
$$w(z) = w_0 e^{\ln\left(\frac{w_1}{w_0}\right)\frac{z}{L}}$$

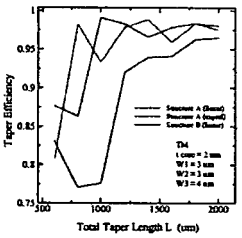


$n_{co} = 1.65$

$n_{cl} = 1.45$ (all around)

point width = 1μm





Note that the core thickness is 2μm here, and the Taper efficiency is calculated just after the coupler length L.

Brent Little
4 March 1, 2002

Exhibit K

Little Optics Inc.
9020 Junction Drive
Annapolis Junction, MD20701

Purchase Order

Account #	Date	P.O. Number
	7/25/2002	01-478

Vendor	Ship to
DuPont Photomask, Inc. P.O. Box 98089 Chicago, IL 60693	Little Optics, Inc. 9020 Junction Drive, Suite D Annapolis Junction, MD 20701 Tel: (301) 604-7668 Attn: John Hryniewicz (301) 604-7668 x224

Item	Description	Qty.	Rate	Amount
TPR6 BUSWVG	Material: 6" x 6" .250" AR QTZ 2 µm Data format: GDSII Address: 0.05 µm Write tool: Core 2564 Minimum feature: 1.25 µm Critical dimension: 1.25 µm or larger CD tolerance: +/- 0.1 µm Registration: N/A Defects size: 1.5 µm Defect density: 0 defects / sq in Pellicle: none	1	2,845.00	2,845.00
TPR6 LARGE-12	Material: 6" x 6" .250" AR QTZ 2 µm Data format: GDSII Address: 0.05 µm Write tool: Core 2564 Minimum feature: 1.25 µm Critical dimension: 1.25 µm or larger CD tolerance: +/- 0.1 µm Registration: N/A Defects size: 1.5 µm Defect density: 0 defects / sq in Pellicle: none	1	2,845.00	2,845.00
Refer to Quote No.L0053002Q			Total	

Page 1

Little Optics Inc.
9020 Junction Drive
Annapolis Junction, MD20701

Purchase Order

Account #	Date	P.O. Number
	7/25/2002	01-478

Vendor	Ship to
DuPont Photomask, Inc. P.O. Box 98089 Chicago, IL 60693	Little Optics, Inc. 9020 Junction Drive, Suite D Annapolis Junction, MD 20701 Tel: (301) 604-7668 Attn: John Hryniewicz (301) 604-7668 x224

Item	Description	Qty.	Rate	Amount
TPR6 LARGE-13	Material: 6" x 6" .250" AR QTZ 2 µm Data format: GDSII Address: 0.05 µm Write tool: Core 2564 Minimum feature: 1.25 µm Critical dimension: 1.25 µm or larger CD tolerance: +/- 0.1 µm Registration: N/A Defects size: 1.5 µm Defect density: 0 defects / sq in Pellicle: none		2,845.00	2,845.00
Refer to Quote No.L0053002Q			Total	$8,535.00

Page 2

BEST AVAILABLE COPY

DuPont Photomasks Inc.
131 Old Settler's Blvd. Round Rock, TX. 78664 (Corporate)
1901 East Morgan Street, Kokomo, IN. 46901
100 Texas Avenue, Round Rock, TX. 78664
2920 Coronado Drive Santa Clara, CA. 95054

Customer Requirements Form

1. Company: Little Optics, Inc. 2. Contact: John Hryniewicz 3. Phone: (301) 604-7668 x224; (301) 706-9928 4. Fax: (301) 604-8286
5. Date: 07/25/2002 6. Purchase Order #: 01-478 7. Email Address: johnh@littleoptics.com
8. Device Name: TPR6.SF 9. Product Type: 5X 10. Stepper Type: (X) Ultratech-XLS ( )GCA ( )ASML
11. Substrate Type: (X)Quartz ( )Low Expansion-N/A ( )Soda Lime/White Crown 12. Substrate Size: ( ) 4" ( )5" (X)6" ( )7" ( )7.25"
13. Substrate Thickness "mil": (X).250 ( ).150 ( ).120 ( ).090 ( ).060 14. Substrate Reflectivity: (X) Anti Reflective "Standard"
( )High Reflective Special
( )Medium Reflective Order
( )See Through Material
15. Write System: ( )Ebeam (X)Laser ( )Any CORE 2564
16. Plots: ( ) 8.5"X11" ( ) 36" Fracture result (GDSII) to ftp for approval (see letter)
17. Data Format Supplied: ( )AutoCad/DXF ( )CIF (X)GDS ( )Mebes ( )Other _____ 18. CD Location:
(X)Diagrams Attached ( ) No CD
19. Supplied Data: (X)Right Reading ( )Wrong Reading
20. Nikon Mark Separation: X. Y. (X) No Marks

Critical Dimensions:	Registration Inspection:	Defect Inspection:
Inspection Required: Yes (X) Guaranteed ( ) No ( ) Ship Data w/Plate (X) CD Tolerance: (X) Tolerance ( )Mean to Nominal CD Uniformity: ( )Range ( )3 sigma (-) Dev. from Mean NIST Standard: (X) Yes ( )No	Inspection Required: Yes ( ) Guaranteed ( ) No (X) Ship Data w/Plate ( ) Measure File Provided ( )Yes (X)No Reference: ( )Layer_____ ( )Grid (-) Array Runout _____ +/- ( ) Die Fit _____ +/- ( )Insert Fit _____ +/- ( )Field Fit (1XUT) _____ +/- (-)Orthogonality _____ +/-	Inspection Required: Yes (X Guaranteed ( ) Visual Inspection (>3.0um) ( ) No ( ) Ship Data w/Plate (X) Klaris Required: ( )Yes ( )No ( )Prime ( ) Test ( )Other Specific Layer(s) _____ Defect Size: Clear 1.5 micron Dark 1.5 micron Defect Density: (X) 0 ( ) 0.5 ( ) 1.0 ( ) 2.0 Defect Description: (X)Defects per sq. Inch ( )Defective Die per sq. Inch

DuPont Photomasks Inc. Page 1 9/22/99djs